



# Improving stability in South-Western NSW

RIT-T - Project Assessment Conclusions Report

Region: South Western New South Wales

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People. Power. Possibilities.

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# Summary

South-western New South Wales (NSW) has seen significant growth in renewable generation connections to the transmission network as part of the wider energy market transition. More than 790 MW of renewable generation has connected in South-western NSW since December 2015 and approximately 580 MW of renewable generation is currently in the process of being commissioned.

This new generation is having an impact on how this part of the power system operates, with the resultant changes in power flows leading to an increasing risk of system instability going forward. This resulted in the Australian Energy Market Operator (AEMO) introducing an operational constraint in the NEM Dispatch Engine (NEMDE) in May 2020 to limit power flows, in order to manage the risks to system stability.<sup>1</sup>

We have identified the opportunity to strengthen the transmission network in south-western NSW to relieve this constraint and provide market benefits to the National Electricity Market (NEM).

This Regulatory Investment Test for Transmission (RIT-T) process was initiated to progress and consult on the assessment of investment options and whether the market benefits outweigh the costs of the investments. Publication of this Project Assessment Conclusions Report (PACR) is the final formal document in the RIT-T process and follows the Project Assessment Draft Report (PADR) released in September 2021.

## Overview

The PACR finds that a new Darlington Point to Dinawan 330 kV transmission line coupled with an interim 3-year network support contract with a battery energy storage system (BESS) solution ('Option 4') is the preferred option for meeting the identified need across all scenarios and sensitivities assessed. Option 4 is expected to deliver approximately \$91 million in net benefits over the 27 year assessment period (on a weighted-basis).

The BESS is being developed by Edify and is expected to provide network support from 2023/24 to 2025/26 (when the new line is expected to be commissioned).

Option 4 is expected to provide net benefits to consumers and producers of electricity and to support energy market transition by allowing for more efficient sharing of generation across the NEM through relieving the current constraint in south-western NSW. The market modelling finds that this defers, or avoids, significant costs associated with the construction of new, more expensive generation and/or storage capacity in the NEM in all three scenarios assessed in this PACR. Under the progressive change scenario, although the benefit of this avoided/deferred investment is lower, the option also provides significant avoided fuel costs in the NEM through avoiding the use of higher cost generators to meet demand.

The estimated capital costs of the network elements of Option 4 are \$166.9 million. The proposed annual network support cost (opex) is \$3.25 million/year for the three years of support. The network support component has no incremental capital costs compared to the base case (since the BESS that will provide the network support is currently being developed independently and is considered 'committed').

While the ability of the BESS component to relieve the constraint still requires full technical feasibility to be confirmed and agreed with AEMO, we consider Option 4 a 'no regrets' option at this stage.

<sup>1</sup> This constraint was updated on 1 December 2021 following the commissioning of a proponent-funded temporary special protection scheme (SPS) in the area.

Specifically, should the BESS ultimately not be considered able to address the constraint, or not be able to provide network support ahead of the new line being commissioned, Option 1A (the new Darlington Point to Dinawan 330 kV transmission line alone) will be considered the preferred option and will proceed on the same timeframe. Option 1A is the second-ranked option in the PACR assessment, and also has significantly positive net benefits, across all three scenarios assessed.

Both Option 4 and Option 1A are expected to generate sufficient benefits to recover their costs within five years of commissioning the new line in the step-change and hydrogen superpower scenarios, and within 11 years in the progressive change scenario.

This RIT-T also considered a brownfield option (Option 1B) to rebuild existing transmission lines.<sup>2</sup> As noted, the outcome of the RIT-T is that Option 4, which involves a greenfield lines component (i.e. Option 1A), has the highest net market benefits. Despite this, we note that the brownfield option (Option 1B) is more consistent with Transgrid's overall general preference for brownfield investments.

Importantly, for greenfield transmission line investments, the RIT-T does not address line route specifics for the preferred option.<sup>3</sup> These are scoped by the TNSP and assessed within the Environmental Impact Statement (EIS). Planning approval would only be granted by the NSW Minister for Planning and Public Spaces following extensive, genuine community and stakeholder consultation and demonstration that environmental impacts can be effectively managed or mitigated. This process will commence following the conclusion of this RIT-T.

## Benefits from improving the stability of the south-western NSW power system

Our system studies have highlighted that the 132 kV system in south-western NSW can experience significant stability issues during an outage of Line 63 (the 330 kV transmission line from Darlington Point to Wagga Wagga), including thermal overloads and under-voltage. These issues are being driven by the increased levels of renewable generation in the area.

If action is not taken, the 132 kV system will experience even more significant stability issues during an outage of Line 63, including fast voltage collapse, thermal overloads and under-voltage. There is a particular risk of fast voltage collapse that would result in power electronics-based renewable generation becoming unstable and result in cascading generator outages and further stability issues.

Based on our advice, AEMO implemented a new system normal constraint in the NEMDE on 8 May 2020 to limit power flows on Line 63, which was updated on 1 December 2021 following the commissioning of a proponent-funded temporary special protection scheme (SPS). This constraint has been developed to minimise the risk of voltage collapse at Darlington Point and the constraint equation includes generators in south-west NSW and north-west Victoria as well as Murraylink.

The limit for power flows east is approximately 300 MW, although it will vary slightly with power system conditions. With new renewable generators continuing to be commissioned in south-western NSW, the power flow is now reaching this limit regularly during daytime. Power flows east from existing generation in south-western NSW presently peak at more than 790 MW and a further 580 MW of generation is due to be

<sup>2</sup> 99T Darlington Point to Coleambally and 99L Coleambally to Deniliquin as 330 kV to Dinawan

<sup>3</sup> Instead, the RIT-T approval process reviews, and publicly consults on, a TNSP's application for new investment to meet an identified need. Overall, it identifies the technical solution to the need that provides the greatest net benefit to the NEM overall. This RIT-T process is undertaken in consultation with consumers, AEMO, Registered Participants and other interested parties regarding the investment options under consideration.

commissioned in south-western NSW in 2021-22. This has resulted in material constraints to some generators in the region.

Many of the submitters to the PADR highlighted the impact of the constraint on generation in the NEM. All of the existing or new renewable generators in south-western NSW that submitted to the PADR commented on the impact of the constraint.

The identified need for this RIT-T is to increase overall net market benefits in the NEM through relieving existing and forecast constraints on generation connecting to the transmission network in south-western NSW.

## Key developments since the PADR have been reflected in the PACR

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There have been a number of key developments since the PADR was released in September 2021 that have affected the analysis in this PACR. Namely:

- the draft 2022 ISP being published in December 2021;
- early closures announced for coal power plants;
- a change in the statuses of the two non-network proposals assessed in the PADR, including the BESS in the preferred option (Option 4) now being considered 'committed' under the RIT-T;
- additional renewable generation connections (actual and planned) in the area; and
- a proponent in the area funding and commissioning a temporary SPS.

Each of these has been carefully considered and reflected, where relevant, in the PACR assessment.

In addition, we received submissions from six parties on the PADR, which can be grouped as follows:

- existing or new renewable generators in south-western NSW – Darlington Point Solar Farm, RWE Renewables Australia, Reach Solar Energy Co, Iberdrola Australia and one party who wished to remain confidential; and
- the Public Interest Advocacy Centre (PIAC).

While submissions covered a range of topics, there were seven broad topics that were most commented on:

- support for the identified need;
- current cost recovery arrangements;
- feasibility of BESS options;
- support for interim solutions;
- comments on the scenario analysis;
- future proofing the options; and
- the RIT-T timeframes and construction timetable.

The key matters raised in submissions relevant to the RIT-T assessment are summarised in this PACR, together with our responses and how the matters raised have been reflected in the assessment.

## The PACR assessment covers six different credible options

The table below summarises the credible options assessed in this PACR.

Table E-1: Summary of the credible options

Option	Description	Estimated capital cost*	Expected commissioning year
1A	Establish a new Darlington Point to Dinawan 330 kV transmission line	\$166.9 million	2025/26
1B	Rebuild the existing 99T Darlington Point to Coleambally and 99L Coleambally to Deniliquin as 330 kV to Dinawan	\$222.2 million	2025/26
2	Establish a new Wagga Wagga to Darlington Point 330 kV transmission line	\$285.4 million	2026/27
3	STATCOM (100 MVar)	\$33.2 million	2025/26
4	Option 1A + 3-year interim network support solution utilising a BESS (proposed by Edify)	\$166.9 million for the network component The network support component has no incremental capital costs compared to the base case (since it is considered 'committed'). The proposed annual network support cost (opex) is \$3.25 million/year for the three years of support.	2025/26 for the network component 2023/24 for the network support from the BESS
5	A standalone long-term BESS solution (network owned)	\$216.0m (initial) \$102.1m (reinvestment)	2024/25 (initial) 2044/45 (reinvestment)

\* While the capital costs are shown at an aggregate level in this table, they have been broken out by key cost category for each option in the body of this PACR, i.e., substation works, line works, property/land access/easement costs and battery costs (where relevant).

Option 4 involves the use of an interim BESS that was proposed by a third-party (Edify) in response to the PSCR. Edify would be the owner of the BESS under this option and would be paid a network support payment. We note that, since the PADR was released, the BESS component of this option (which is being independently developed) has now been confirmed as meeting the criteria for a 'committed' investment.

The PADR also included a third-party owned stand-alone BESS solution (Option 5). While the proponent for this solution has since withdrawn their offer, the PACR continues to assess a stand-alone BESS solution for completeness but now assumes that it would be Transgrid-owned. The cost, build time and operating characteristics of this option are based on our internal database for such solutions and do not draw on what was proposed by the original proponent of this option.

The capital costs for all options have been revised since the PADR to take account of current market trends and risks, drawing on the experience of recent projects as well as a detailed review of the scope of each option. The revised costs in this PACR are consequently lower than in the PADR as a result of this process.



## Three scenarios have been assessed

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The RIT-T is focused on identifying the top-ranked credible option in terms of expected net benefits. However, uncertainty exists in terms of estimating future inputs and variables (termed future ‘states of the world’).

To deal with this uncertainty, the NER requires that costs and market benefits for each credible option are estimated under reasonable scenarios and then weighted based on the likelihood of each scenario to determine a weighted (‘expected’) net benefit. It is this ‘expected’ net benefit that is used to rank credible options and identify the preferred option.

The credible options have been assessed under three scenarios as part of this PACR assessment, which differ in terms of the key drivers of the estimated net market benefits. These scenarios have been updated since the PADR. Specifically, we have now modelled the market benefits of each of the options across each of the following three 2022 ISP scenarios, which we have then weighted based on the relative weightings proposed in the draft 2022 ISP:<sup>4</sup>

- step-change (52 per cent weighting);
- progressive change (30 per cent); and
- hydrogen superpower (18 per cent).

## Option 4 is found to be the preferred option across all scenarios and sensitivities investigated

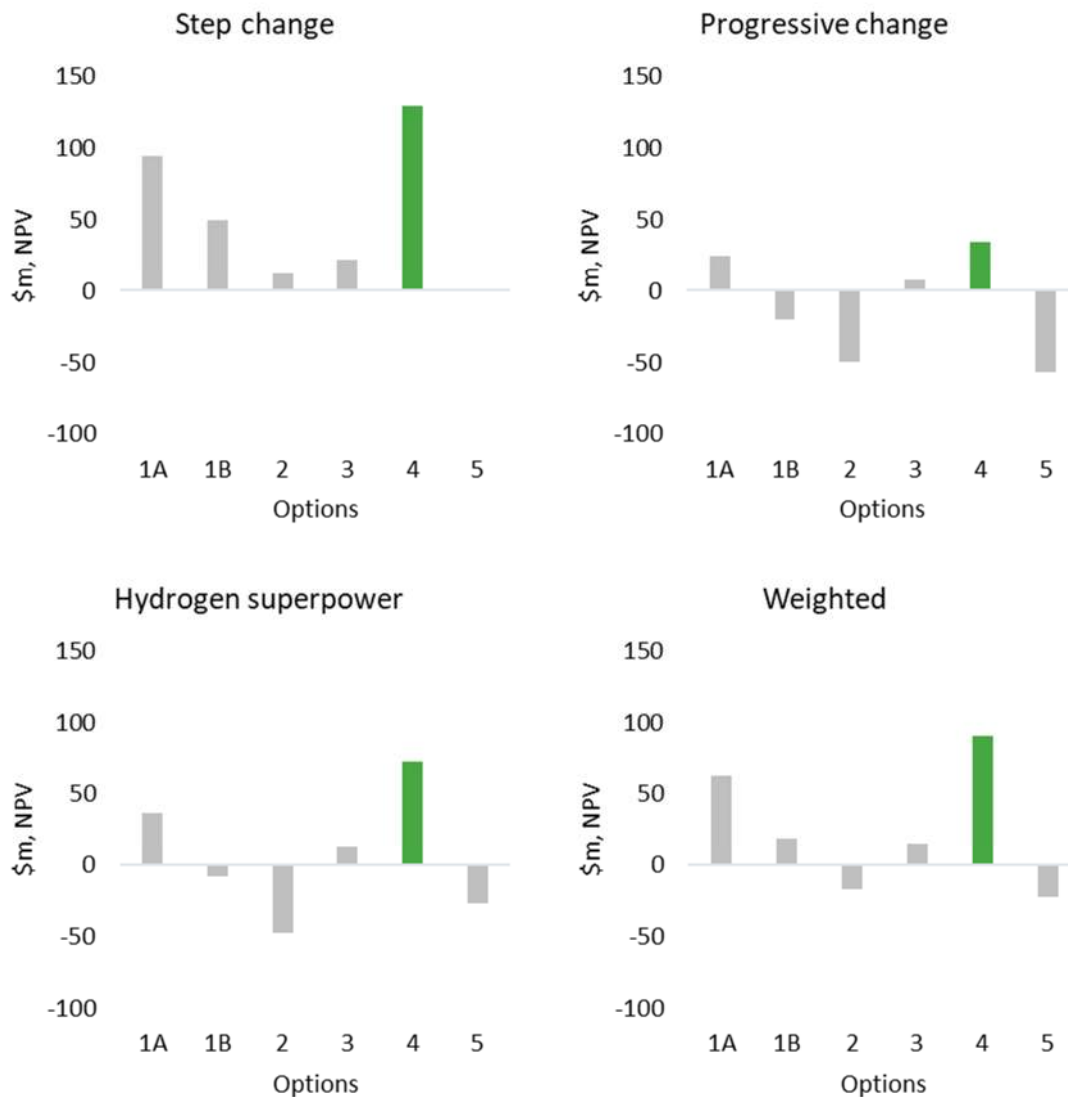
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The PACR assessment finds that a new Darlington Point to Dinawan 330 kV transmission line coupled with an interim 3-year BESS solution (‘Option 4’) is the preferred option for meeting the identified need across all three scenarios assessed. Option 4 is expected to deliver approximately \$91 million in net benefits over the 27 year assessment period (on a weighted-basis).

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<sup>4</sup> Specifically, we have given each scenario a weighting based on the proportion its weighting in the draft 2022 ISP makes up of the cumulative weight given to these three scenarios (as outlined in section 5.1).

Figure E-1: Estimated net benefits for each scenario



Option 1A, which is the new Darlington Point to Dinawan 330 kV transmission line alone (without the interim BESS component) is the second-ranked option in the PACR assessment, and also has significantly positive net benefits, across all three scenarios assessed.

The vast majority of the estimated market benefits for the options in each scenario comes from their ability to defer, or avoid, significant costs associated with the construction of new, more expensive generation and/or storage capacity in the NEM. Under the progressive change scenario, although the benefit of this avoided/deferred investment is lower, the options also provide significant avoided fuel costs in the NEM through avoiding the use of higher cost generators to meet demand.

We have also tested the robustness of the conclusion that Option 4 is the preferred option to a range of sensitivities as part of this PACR – namely:

- the impact of the temporary SPS funded by a proponent in the area;
- changes in the capital costs of the credible options; and

- alternate commercial discount rate assumptions.

Each sensitivity confirms Option 4 as the preferred option under this RIT-T.

In terms of capital costs, we find that they would need to increase by approximately 79 per cent in order for Option 4 to have negative expected net benefits, and by 55 per cent for Option 1A to have a negative net benefit. There is no realistic capital cost change that would result in Option 1B (the third-ranked option) being ranked equally with either Option 4 or Option 1A.

If future cost estimates do increase materially, we would reassess the NPV analysis in light of this change and the thresholds set out above, to identify whether it would constitute a 'material change in circumstances' (i.e., under clause 5.16.4(z3) of the NER) that would trigger re-application of the RIT-T.

We note that the ability of the BESS component to relieve the constraint under Option 4 still requires full technical feasibility to be confirmed and agreed with AEMO, as well as a network support contract to be negotiated and agreed between Edify and Transgrid. However, we consider Option 4 a 'no regrets' option at this stage. Specifically, should the BESS not be considered able to address the constraint, ahead of the new line being commissioned, Option 1A (which is the new Darlington Point to Dinawan 330 kV transmission line alone) will be considered the preferred option, and would proceed on the same timeline as it would as a component of Option 4.

## Further information and next steps

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This PACR represents the final stage in the RIT-T process.

We are now in the midst of the pre-investment activities necessary to proceed with the preferred option.

Our current revenue determination has a contingent project for this RIT-T (the 'support south western NSW for renewables' contingent project). A key next step is therefore to submit a contingent project application to the AER once all triggers have been met. The application process will determine the required expenditure to be added to Transgrid's revenue requirement in the next regulatory period.

We will also continue to perform technical analysis to confirm the ability of the BESS to increase the transfer limits, as assumed in this PACR, which is expected to be completed by September 2022. Following this analysis, Transgrid will liaise with AEMO to agree on the transfer limits with the BESS assumed to be in-place, which is expected to be completed by December 2022. Successful completion of these two stages will allow Transgrid to proceed to signing a network support contract with Edify.

Further details in relation to this project can be obtained from [regulatory.consultation@transgrid.com.au](mailto:regulatory.consultation@transgrid.com.au).